PO3032

PROTEIN ADHESION ON ATMOSPHERIC PLASMA DEPOSITED ACRYLIC ACID COATINGS

Mick Donegan[1], D.P. Dowling[1]

[1]UCD Mechanical and Materials Engineering, Dublin, Ireland

michael.donegan@ucd.ie

Protein adhesion to implant surfaces is one of the key parameters influencing medical device performance. Acrylic Acid coatings, in particular, are of interest, as their polar component has been demonstrated to facilitate the adhesion of a range of biomolecules. Coating stability in aqueous solution is however an important consideration. This study is focused on developing water stable acrylic acid coatings deposited using an atmospheric plasma technique as this should facilitate a continuous coating process. The performance of these plasma polymerised coatings was evaluated based on dynamic protein adhesion tests. Preliminary deposition trials were carried out using a helium atmospheric plasma jet system called PlasmaStream™. This involved nebulising the monomer directly into the plasma to form a plasma polymerized acrylic acid coating. The resulting coatings however were unstable in aqueous solution and so unsuitable for protein adhesion testing. Further deposition trials were carried out using an air based atmospheric plasma jet system known as PlasmaTreat™. Coatings deposited using this technique was found to give good water stability, possibly due to enhanced levels of cross-linking. Coating properties were examined using ellipsometry, optical profilometry, contact angle, SEM and XPS. These techniques were used to evaluate thickness, surface energy, surface morphology and chemical functionality respectively. Protein adhesion rate and thickness was evaluated under dynamic flow conditions from aqueous mixtures of the proteins using the spectroscopic ellipsometry technique. These adhesion tests were carried out using bovine serum albumin (BSA), bovine fibrinogen (Fg) and bovine immunoglobulin (IgG).The rate of adhesion and thickness of the individual protein layers was determined for both the coated and uncoated silicon wafer substrates. The thickness of the protein layer was verified using quartz crystal microbalance measurements. From this study it was concluded that the level of protein adhesion on the uncoated and acrylic acid coated wafer substrates was found to be dependent on protein type. In the case of BSA for example a 2 nm thick protein layer was obtained on uncoated wafers, while the coated surfaces exhibited an enhanced protein thickness of 8 nm.

Keywords
Biomedical, Coating, Acrylic Acid, Atmospheric Plasma